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MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2016/2017

EEM1016 – ENGINEERING MATHEMATICS I
(All sections / Groups)

02 JUNE 2017
3.00 p.m - 5.00 p.m
(2 Hours)

INSTRUCTION TO STUDENT

1. This Question paper consists of 4 pages (including cover page) with 4 Questions only.
2. Attempt ALL questions. The distribution of the marks for each question is given.
3. Please write all your answers in the answer booklet provided.

Question 1(25 marks)

(a) Find the following limits:

(i) $\lim_{x \rightarrow +\infty} \frac{6x-5}{2+e^{3x}}$ [3 marks]

(ii) $\lim_{x \rightarrow 5} \frac{x^2 - 2x - 15}{x^2 - 7x + 10}$ [3 marks]

(b) Find $\int x^2 \ln x \, dx$ [4 marks]

(c) Let $f(x) = x^3 - 4x^2 - 9x - 4$ in the closed interval $[-1, 4]$.

(i) Identify the critical points of $f(x)$. [3 marks]

(ii) Hence, find the absolute extreme values of the function. [4 marks]

(d) If the radius increases from 1.00m to 1.02m and the height decreases from 1.00m to 0.98m of a closed cylinder, determine the approximate change of each (i) and (ii) by using the differentials. (Leave your answer in π form)

(i) surface area [5 marks]

(ii) volume [3 marks]

Question 2(25 marks)

(a) (i) Find the real values of x and y if $(x - iy)(2 + 3i) = 6 - i$ [5 marks]

(ii) Let $w = \frac{1}{2} + \frac{1}{2}i$. Use De Moivre's theorem to find all the cubic roots of w by solving the equation $z^3 = w$. [7 marks]

Continued...

- (b) (i) Find the vector and parametric equations for the line passing through $P(1,2,1)$ and perpendicular to the plane: $3x - 7y + 5z = 14$. [5 marks]
- (ii) Find an equation for the plane passing through the point $A(-2,1,3)$, $B(-1,-3,1)$ and $C(-3,2,-4)$. [6 marks]
- (iii) Given $\hat{v} = 2i + j$ and $\hat{u} = 2i + 2j + 3k$. Find $\hat{u} \cdot \hat{v}$. [2 marks]

Question 3(25 marks)

- (a) (i) Let $f(x) = \cos x + \sin^2 x$. Is the function f odd, even or neither odd nor even? Give your justification. [5 marks]
- (ii) Let $g(x) = \sin 4x$ and $h(x) = \sin x + \cos \frac{x}{2}$. Find the periods of g and h . [5 marks]

- (b) A 2π period odd function f is defined by

$$f(x) = \begin{cases} -1 & -\pi < x < 0, \\ 1 & 0 < x < \pi. \end{cases}$$

- (i) Sketch the graph of f for $-3\pi < x < 3\pi$. [5 marks]
- (ii) Find the Fourier series of f . [10 marks]

Continued...

Question 4(25 marks)

- (a) List the first three terms of the following sequence:

(i) $\left\{ \frac{4n}{n^2 - 7} \right\}_{n=0}^{\infty}$ [3 marks]

(ii) $\left\{ \frac{(-1)^{n+1}}{2n + (-3)^n} \right\}_{n=2}^{\infty}$ [3 marks]

- (b) Determine if the given sequence converges or diverges. If it converges, determine its limit.

(i) $\left\{ \frac{n^2 - 7n + 3}{1 + 10n - 4n^2} \right\}_{n=3}^{\infty}$ [3 marks]

(ii) $\left\{ \frac{(-1)^{n-2} n^2}{4 + n^3} \right\}_{n=0}^{\infty}$ [3 marks]

(iii) $\left\{ \frac{e^{5n}}{3 - e^{2n}} \right\}_{n=1}^{\infty}$ [3 marks]

- (c) Determine the interval and radius of convergence for the following power series.

$$\sum_{n=0}^{\infty} \frac{1}{(-3)^{2+n} (n^2 + 1)} (4x - 12)^n$$
 [10 marks]

End of Paper